Long-term Monitoring of 1977 Tundra Fires in the Northwest Alaska Parks

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The frequency and size of lightning-caused tundra fires could increase with climate warming and may result in major ecosystem changes in vegetation, soils, and wildlife habitat over large areas of the arctic. Two of the longest monitored sites (28-32 years) in Arctic Alaska for vegetation change and post-fire tundra succession are located in Bering Land Bridge (BELA) and Noatak (NOAT) National Preserves in northwestern Alaska. These permanent vegetation plots were established following widespread tundra and forest fires in 1977, when one million acres burned during an extremely dry year in northwestern Alaska (*Racine et al. 1987, 2004*). Recently the NPS Arctic Network Inventory and Monitoring Program has supported re-measurements of these sites.

The BELA site on the Seward Peninsula is located where a large 1977 tundra fire burned a west facing slope along Imuruk Lake (Nimrod Hill). Pre-fire vegetation and soils along this slope ranged from moist tussock-shrub tundra on the lower slopes to dwarf shrub tundra on the steeper upper-slope (12%) and wet sedge meadow on the ridge top. We sampled vegetation before the fire in 1973 and at eight sites following the fire at irregular time intervals from one year to 32 years. Over the monitoring period we have seen dramatic changes in vegetation on Nimrod Hill (*Figure 1*), particularly on the severely burned upper-slope. Immediately after the fire, the upper-slope sites were dominated by pioneering mosses and liverworts (*Figure 2*), followed by sedges and grasses within a decade (*Figure 3*). Twenty to 30 years after the fire, both deciduous and evergreen shrubs expanded dramatically at all sites on the hill; particularly on the upper slope where fast growing willows (*Salix pulchra*) now up to 5 ft (1.5 m) tall, currently cover 30-40% of the slope (*Figure 4*). The thaw depths and active layer thickness have recovered to pre-fire levels at the lower-slope tussock tundra sites; however, there is evidence for major permafrost thawing and surface subsidence on the well-drained slope in the area colonized by willows. We have seen slow recovery of Sphagnum moss and lichens 32 years after fire. The loss of Sphagnum moss could change the hydrologic and water retention capacity of tussock tundra and the loss of lichens could reduce winter forage for caribou and reindeer. This long-term record of change provides valuable documentation of fire effects on vegetation, permafrost, and wildlife habitat during an era of rapid climate warming in the Alaska Arctic.

REFERENCES

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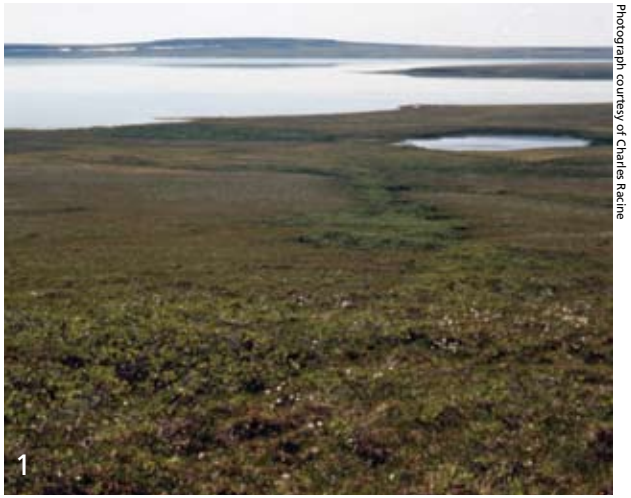

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Figure 1. 1973 pre-fire view downslope to Imuruk Lake from the upper face of Nimrod Hill dominated by dry dwarf shrub tundra mat.

Figure 2. 1978 one year post-fire on the severely burned upper slope. Cover was dominated by early successional mosses and liverworts with bare frost boils and exposed rock.

Figure 3. 1983 six years post-fire, this site was dominated by sedges (*Carex*) and grasses (*Calamagrostis*) that overgrew the mosses and liverworts. Gary Ahlstand, former AKRO NPS Research Ecologist, shown in photo.

Figure 4. 2009 thirty-two years post fire, what once was dwarf shrub tundra at this site is now tall willow. Randi Jandt, BLM Fire Ecologist, shown in photo.